# SMART EXAM RESOURCES
# 9702 PHYSICS TOPIC QUESTIONS
## TOPIC: PHYSICAL QUANTITIES AND UNITS
## SUB-TOPIC: ERRORS AND UNCERTAINITIES
## SUB-SUB-TOPIC: DISTINGUISH BETWEEN PRECISION AND ACCURACY



1 Distinguish between precision and accuracy when measuring the diameter of a wire.

precision: .....

.....

accuracy: .....

.....

[2]

## MARKING SCHEME:

| | | |
|---|---|---|
| precision: the size of the smallest division (on the measuring instrument)<br>*or*<br>0.01 mm for the micrometer | B1 | |
| accuracy: how close (diameter) value is to the true (diameter) value | B1 | [2] |

2 The student repeats the experiment three times and uses the results to calculate the depth of the well. The values are shown in Table 1.1.

**Table 1.1**

| | 1st experiment | 2nd experiment | 3rd experiment |
|---|---|---|---|
| depth/m | 54.4 | 53.9 | 54.1 |

The true depth of the well is 36.0 m. Explain why these results may be described as precise but not accurate.

.....

.....

.....

..... [2]

## Mark Scheme:

| | | |
|---|---|---|
| | precise: results are close together / have little scatter | **B1** |
| | not accurate: the values are not close to / 50% different / (very) different from the true value | **B1** |

3 A set of experimental measurements is described as precise and not accurate.

State what is meant by:

**(i)** precise

.....

..... [1]

**(ii)** not accurate.

.....

..... [1]

## Mark Scheme:

| | | |
|---|---|---|
| )(i) | the measurements have a small range | **B1** |
| ı(ii) | (average of the) measurements not close to the true value | **B1** |

4 A student uses a micrometer screw gauge to measure the diameter of a wire. He fails to notice that, with the gauge fully closed, the reading is not zero.

**(a)** State and explain whether the omission introduces a random error or a systematic error into the readings of the diameter.

.....

.....[2]

**(b)** Explain why the readings are precise but not accurate.

.....

.....

.....[2]

## Mark Scheme:

**(a)** because all readings have same error
OR can't be eliminated by repeating and averaging ..... B1
error is systematic ..... B1 [2]
(do not allow 'systematic' if argument is fallacious)

**(b)** micrometer measures to fraction of millimetre so is precise
OR if repeated, reading is (almost constant) ..... B1
but all readings have error so is not accurate ..... B1 [2]

5 A beam PQ is clamped so that the beam is horizontal. A mass $M$ of 500 g is hung from end Q and the beam bends slightly, as illustrated in Fig. 1.1.

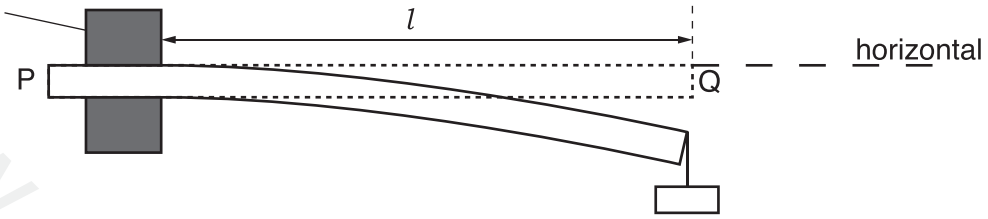


**Fig. 1.1**

The length $l$ of the beam from the edge of the clamp R to end Q is 60.0 cm. The width $b$ of the beam is 30.0 mm and the thickness $d$ of the beam is 5.00 mm. The material of the beam has Young modulus $E$.

The mass $M$ is made to oscillate vertically. The time period $T$ of the oscillations is 0.58 s.

The period $T$ is given by the expression

$$T = 2\pi \sqrt{\frac{Ml}{3}}.$$

**(ii)** The quantities used to determine $E$ should be measured with accuracy and with precision.

**1.** Explain the difference between accuracy and precision.

accuracy: .....

.....

precision: .....

.....

[2]

**2.** In a particular experiment, the quantities $l$ and $T$ are measured with the same percentage uncertainty. State and explain which of these two quantities contributes more to the uncertainty in the value of $E$.

.....

.....

.....[1]

## MARKING SCHEME:

| | | |
|---|---|---|
| )(ii)1. | (accuracy determined by) the closeness of the value(s)/measurement(s) to the true value | **B1** |
| | (precision determined by) the range of the values/measurements | **B1** |
| )(ii)2. | $t$ is (cubed so) 3 × (percentage/fractional) uncertainty<br>**and** $T$ is (squared so) 2 × (percentage / fractional) uncertainty<br>**and** (so) $t$ contributes more | **B1** |